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## THE BUTTERFLIES (LEPIDOPTERA) OF CHRISTMAS ISLAND, INDIAN OCEAN

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### Abstract

Twenty two butterfly species are now known to occur on Christmas Island. This paper lists seven species previously unrecorded, viz. *Papilio demoleus malayanus* Wallace, *Eurema blanda* (Boisduval), *Nacaduba kurava* (Moore), *Jamides bochus* (Stoll), *Catochrysops panormus* (Felder), *Lampides boeticus* (L.) and *Zizina otis* (F.). In addition a second form of *Catopsilia pomona* (F.) is recorded for the first time. Only two species *Eurema amplexa* (Butler) stat. rev. and *Polyura andrewsi* (Butler) are endemic. The male genitalia of *Eurema amplexa* shows that it should not be considered a subspecies of *E. hecabe* (L.) but deserves specific status.

### Introduction

Christmas Island, Indian Ocean, lies some 360 km south of the Indonesian island of Java and about 1400 km from Western Australia. The island is isolated from other landmasses and has an area of approximately 137 sq km. It has a planar surface with a maximum elevation of 357 m and is terraced right around the island.

Rainforest covers much of the island's surface but the number of plant species is lower than one would expect. Two vegetation types can be recognised. A simple mesophyll forest on the plateau and a more complex and diverse flora around the limestone terraces. Ridley (1906) points out that numerous exotic and weed species have been introduced, particularly around areas of human habitation.

The first butterflies to be recorded from Christmas Island were two species described by Butler (1887). The following year he listed an additional

three species (Butler 1888) and later (Butler 1900) he increased the number of recorded species to nine. Pendlebury (1933) brought the number of known species to 11, Corbet (1938) added another and Gibson-Hill (1947) increased the total further to 14 but failed to include the one species mentioned by Corbet (1938). In this paper we record a total of 22 species.

In 1985 one of us (RBL) visited Christmas Island and collected butterflies intensively from 9-31 January. 255 specimens of 13 species were taken which are now housed in the collections of RBL, Australian National Insect Collection, Canberra (ANIC) and British Museum (Natural History) London (BMNH). Other specimens of Christmas Island butterflies previously unstudied are housed in the collections of (ANIC) and Western Australian Museum, Perth (WAM). From all this material and the published literature we summarize below the butterflies now known from Christmas Island including seven previously unrecorded species, *Papilio demoleus malayanus* Wallace, *Eurema blanda* (Boisduval), *Nacaduba kurava* (Moore), *Jamides bochus* (Stoll), *Catochrysops panormus* (Felder), *Lampides boeticus* (L.) and *Zizina otis* (F.), and a second form of *Catopsilia pomona* (F.). One taxon, *Eurema hecabe amplexa* (Butler), has been returned to specific status.

#### List of species

#### FAMILY PAPILIONIDAE

##### *Papilio demoleus malayanus* Wallace

*Material examined.*—1 ♂, Flying Fish Cove, 5.vii.1961, G. F. Mees, WAM Reg. No. 85/1132 (WAM). 2 ♂♂, Flying Fish Cove, 31.vii.1975, Settlement Area, 10.viii.1975, A. N. Gillison; 1 ♀, Flying Fish Cove, 30.vii.1975, B. Bell (ANIC).

Previously unrecorded from Christmas Island.

#### FAMILY PIERIDAE

##### *Catopsilia pomona pomona* (F.)

##### form *pomona*

*Catopsilia crocale crocale* Cramer: Gibson-Hill, 1947: 80.

*Material examined.*—7 ♂♂, 4 ♀♀, Christmas Is., 16, 21, 23, 24.i.1985, R. B. Lachlan (RBL). 1 ♂, Flying Fish Cove, 8.vii.1961, G. F. Mees, WAM Reg. No. 85/1133 (WAM). 4 ♂♂, Settlement, 2, 12, 20.x.1964, T. G. Campbell; 1 ♂ 1 ♀, Flying Fish Cove, 5.viii.1975, A. N. Gillison (ANIC).

Taken in Jan., May, July, Aug., Oct.

##### form *crocale*

*Material examined.*—8 ♂♂, 11 ♀♀, Christmas Is., 12, 14, 16, 21, 23, 24.i.1985, R. B. Lachlan (RBL).

Form *crocale* has not previously been recorded from Christmas Island; the specimen referred to by Gibson-Hill (1947) was, in fact, form *pomona*.

It is interesting to note that this species was not taken on Christmas Island until May 1940 (Gibson-Hill, 1947). Ridley (1906) does not mention any *Cassia* or *Butea* species (the only known food plants of *C. pomona*) but *Cassia* is now a plentiful introduced species on the island.

*Eurema blanda blanda* (Boisduval)

(Figs 1, 3-6)

*Material examined.*—17 ♂♂, 1 ♀, Christmas Island, 12, 13, 15, 19, 21, 23, 24, 25.i.1985, R. B. Lachlan (RBL). 2 ♂♂, ½ ml S of Drumsite, 30.ix.1964, T. G. Campbell; 1 ♂, Flying Fish Cove, 5.viii.1975, A. N. Gillison (ANIC).

Previously unrecorded from Christmas Island. Differs from *E. amplexa* in having the fore wing black band above clearly much broader at wing apex and a fore wing length rarely below 21 mm. The degree of indentation in the fore wing black band is variable; most males we examined showed little indentation, but two taken by RBL are deeply indented. The male genitalia (Fig. 1) are characteristic for the species and in four males we examined, covering the range of border variation, the genitalia are constant.

*Eurema amplexa* (Butler) stat. rev.

(Figs 2, 7-10)

*Terias amplexa* Butler, 1887: 523, fig. 5; Butler, 1888: 544; Butler, 1900: 63; Ridley, 1891: 129, 131.

*Terias patruelis* Butler, 1888: 545 (not Moore); Ridley, 1891: 131.

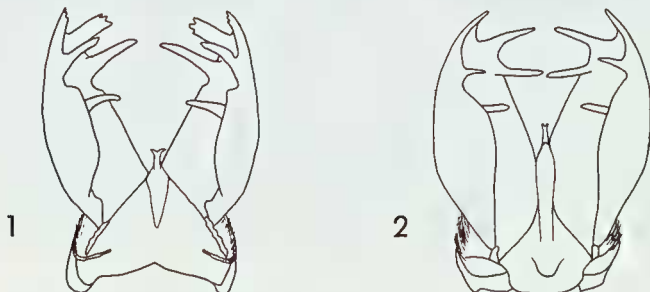
*Terias moorei amplexa* (Butler): Fruhstorfer, 1909-1911, [1910]: 169.

*Eurema hecabe amplexa* (Butler): Corbet & Pendlebury, 1932: 158; Pendlebury 1933: 95; Gibson-Hill, 1947: 75; D'Abbrera, 1982: 183.

*Material examined.*—13 ♂♂, 1 ♀, Christmas Is., 12, 13, 21, 24, 31.i.1985, R. B. Lachlan (RBL). 2 ♂♂, Field 22C area and Field 25 Dales, x.1983, L. Hill; 1 ♀, Settlement, 2.x.1964, T. G. Campbell; 1 ♂, Survey Point, Tom's Ridge, 13.x.1964, C. Coogle; 4 ♂♂, South Point, 8, 21.x.1964, T. G. Campbell; 1 ♂, Flying Fish Cove, viii.1975, A. N. Gillison (ANIC). 2 ♀♀, Blow Hole, 7.vii.1961, G. F. Mees (WAM Coll. Reg. Nos 85/1135, 36); 1 ♀, South Point, 4.vii.1961, G. F. Mees (WAM Coll. Reg. No. 85/1134) (WAM).

Differs from *E. blanda* by not having the fore wing black band above greatly expanded at wing apex. *E. amplexa* is also smaller than *E. blanda* with a fore wing length never exceeding 21 mm while that of *blanda* rarely falls below 21 mm. In addition the fore wing border in the male is always evenly scalloped but that of *blanda* is erratic.

Examination of the male genitalia (Fig. 2) has confirmed that this species is not a subspecies of *E. hecabe* as stated by Corbet & Pendlebury



Figs 1, 2. Male genitalia in ventral view, Christmas Is. *Eurema* spp.: (1) *E. blanda blanda* (Boisduval); (2) *E. amplexa* (Butler) stat. rev.

(1932) and subsequent authors but deserves specific status. The tegumen is much smaller than that of *E. hecabe* and the uncus much longer, more slender and with the apical spines much smaller.

*Appias paulina micromalayana* Fruhstorfer

*Appias paulina micromalayana* Fruhstorfer: Pendlebury, 1935: 95; Gibson-Hill, 1947: 80.

*Material examined.*—1 ♂, Winifred Beach Rd, x.1983, L. Hill (ANIC).

There are records for Jan., Aug., Sep., Oct. and Dec.

FAMILY NYMPHALIDAE

*Danaus chrysippus petilia* (Stoll)

*Limnax petilia* (Stoll): Butler, 1900: 60.

*Danaida chrysippus f. petilia* (Stoll): Pendlebury 1933: 95; Gibson-Hill, 1946: 76.

*Danus chrysippus petilia* (Stoll): Ackery & Vane-Wright, 1984: 138.

There are records for Aug., Sep., and November.

*Euploea climena macleari* (Butler)

*Vadebra macleari* Butler, 1887: 522, fig. 4; Ridley, 1891: 129, 131; Butler, 1900: 61.

*Euploea climena macleari* (Butler): Fruhstorfer, 1910-1911 [1910]: 226-227; Talbot, 1922: xxx-xxx; Gibson-Hill, 1947: 76; D'Abrera, 1982: 214, 215; Common & Waterhouse, 1972: 225 and 1981: 308.

*Trepsichrois climena macleari* (Butler): Ackery & Vane-Wright, 1984: 138; Pendlebury, 1933: 95.

*Material examined.*—25 ♂♂, 4 ♀♀, Christmas Is., 11, 12, 14, 15, 17, 19, 21, 23, 24, 27.i.1985, R. B. Lachlan (RBL). 2 ♂♂, 1 ♀, 1 km S.E. Jack's Hill, Field 25 Murray Hill and Drumsite, x.1983, L. Hill; 11 ♂♂, ½ ml. S. of Drumsite, 30.ix.1964, Grant's Well, 7, 10.x.1964, Anderson's Dale, 15.x.1964, Bean Hill, 15, 19.x.1964, T. G. Campbell; 1 ♂, South Point Rd, 11.x.1964, R. Bishop; 3 ♂♂, Christmas Is., 31.vii.1975, A. N. Gillison; 5 ♂♂, South Point, 31.vii.1975 and 7.viii.1975, A. N. Gillison and B. Bell (ANIC).

Taken in Jan., Mar., July to Nov. A common species usually found gathered in shady areas of forest. Gibson-Hill (1947) records that it "appears after rainy periods—never disappears entirely".

*Euploea core corinna* (W. S. Macleay)

*Trepsichrois eleutho* (Quoy): Pendlebury, 1933: 95-96; Gibson-Hill, 1947: 76.

*Euploea core corinna* Ackery & Vane-Wright, 1984: 138.

*Material examined.*—1 ♂, Flying Fish Cove, 11.vii.1961, G. F. Mees, WAM Reg. No. 85/1131 (WAM). 4 ♂♂, Settlement, 2.x.1964, T. G. Campbell; 1 ♂, 4 ♀♀, Flying Fish Cove, 30.vii.1975, A. N. Gillison (ANIC).

Specimens have been collected from June to October.

*Melanitis ismene* var. *determinata* Butler

*Melanitis ismene* var. *determinata* Butler, 1900: 61; Gibson-Hill, 1947: 80.

Only a single female has been recorded by Butler (1900). It has not been taken since.

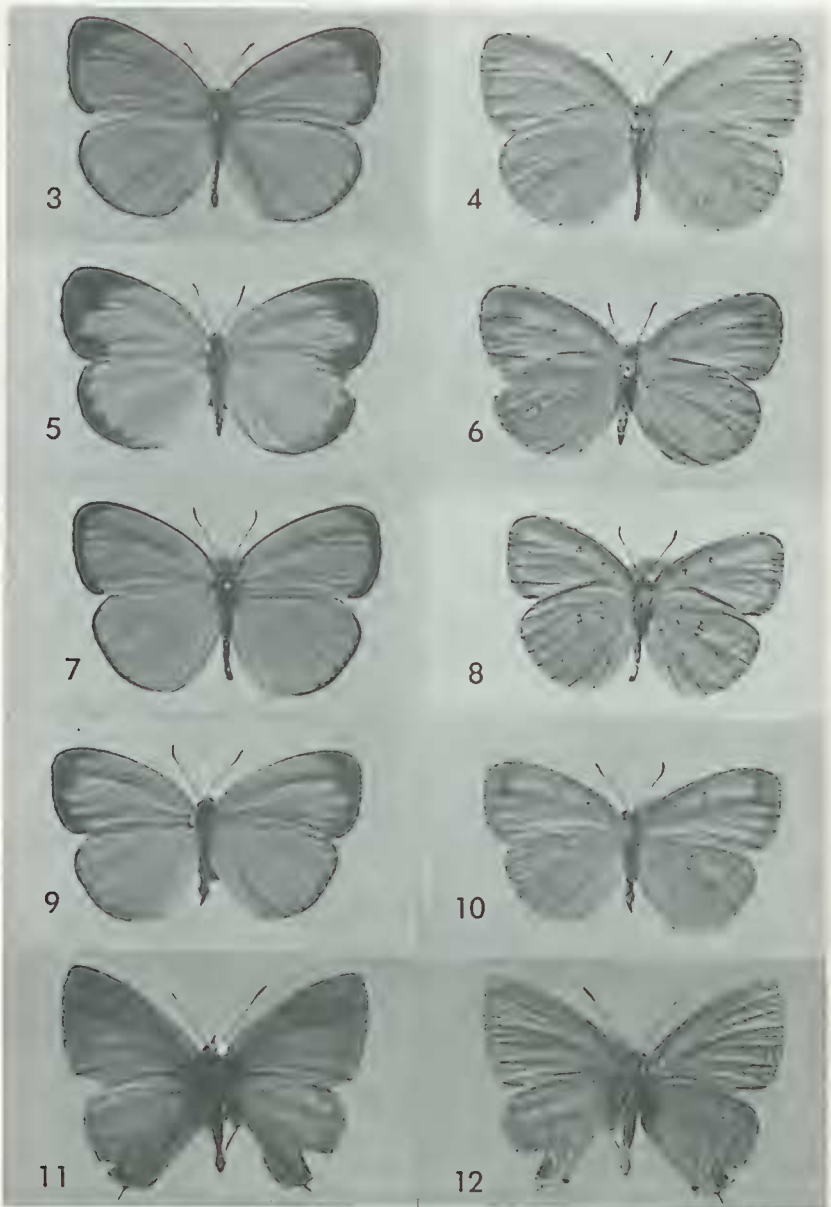
*Polyura andrewsi* (Butler)

*Charaxes andrewsi* Butler, 1900: 61-62, pl. IX, fig. 8.

*Eriboea pyrhus andrewsi* (Butler): Pendlebury, 1933: 96-97; Gibson-Hill, 1947: 79

*Polyura andrewsi* (Butler): Smiles, 1982: 147, 148; D'Abrera, 1985: 384, 385.

*Material examined.*—1 ♂, 3 ♀♀, Christmas Is., 16, 18, 21, 31.i.1985, R. B. Lachlan (RBL).



Figs 3-12. (3-6) *Eurema blanda blanda* (Boisduval): 3, male upperside; 4, male underside; 5, female upperside; 6, female underside; (7-10) *Eurema amplexa* (Butler) stat. rev.: 7, male upperside; 8, male underside; 9, female upperside; 10, female underside (11-12) *Lampides boeticus* (L.): 11, male upperside; 12, male underside.



2 ♀♀, Works area, Settlement, iv.1964, D. Powell; 1 ♀, Hosmes Springs, no date, (probably viii.1975), A. N. Gillison (ANIC).

Specimens have been taken from August to June but probably occur all year round. It flies high, rapidly and rarely settles.

### *Hypolimnas bolina* (L.)

*Hypolimnas listeri* Butler, 1888: 542-544; Ridley, 1891: 131.

*Hypolimnas nerina*, var. *listeri* Butler: Butler, 1900: 62-63.

*Hypolimnas bolina listeri* Butler: Pendlebury, 1933: 96; Gibson-Hill, 1947: 77-79.

*Hypolimnas bolina* (L.): Clarke & Sheppard, 1975: 242, figs 3, 5.

*Material examined.*—5 ♂♂, 34 ♀♀, Christmas Is., 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 25, 27, 30.i.1985, R. B. Lachlan (RBL). 3 ♀♀, Christmas Is., (WAM Reg. No. 85/1125), Phosphate Hill, (WAM Reg. No. 85/1126), Blow Hole, (WAM Reg. No. 85/1127), 7.vii.1961, G. F. Mees, (WAM). 2 ♀♀, Dales Road and Drumsite, x.1983, L. Hill; 1 ♀, Settlement, 14.x.1964, D. Cooke; 5 ♀♀, Phosphate Hill, 10.x.1964, near Jemma Cave, 9.x.1964, Settlement, 2.x.1964; 1 ♀, Settlement, 14.x.1964, Dr K. Richardson; 9 ♀♀, Central Plateau, 10, 12, 15.viii.1975, A. N. Gillison (ANIC).

Specimens have been collected from July to March. The female of the species is highly polymorphic and a wide range of forms are encountered on the island.

### *Hypolimnas misippus* (L.)

*Hypolimnas misippus* (L.): Butler, 1900: 62; Ridley, 1906: 150.

*Hypolimnas misippus misippus* (L.): Gibson-Hill, 1947: 79-80.

*Material examined.*—5 ♂♂, 3 ♀♀, Christmas Is., 11, 13, 16, 21.i.1985, R. B. Lachlan (RBL). 1 ♂, Christmas Is., 5.x.1969, S. Slack-Smith and A. Paterson, WAM Reg. No. 85/1130 (WAM). 1 ♂, Flying Fish Cove, 10.viii.1975, A. N. Gillison (ANIC).

There are records for Jan., Mar., Apr.-May, June, Aug. and October.

### *Hypolimnas anomala anomala* (Wallace)

*Hypolimnas antilope anomala* (Wallace): Pendlebury, 1933: 96; Gibson-Hill, 1947: 77.

*Hypolimnas anomala anomala* (Wallace): Common, 1978: 41, 43, figs 9, 10.

*Material examined.*—25 ♂♂, 8 ♀♀, Christmas Is., 13, 14, 15, 16, 17, 18, 19, 21, 22, 27, 31.i.1985, R. B. Lachlan (RBL). 1 ♂, Phosphate Hill, 7.vii.1961, G. F. Mees, WAM Reg. No. 85/1129 (WAM). 1 ♀, Settlement, 5.x.1969, S. Slack-Smith and A. Paterson, WAM Reg. No. 85/1128 (WAM). 7 ♂♂, 1 ♀, Central Plateau, 15.viii.1975, Flying Fish Cove, 30.vii.1975 and 10.viii.1975, West of Camp 5, viii.1975, A. N. Gillison; 1 ♀, Central Plateau near Field 22, 10.viii.1975, A. N. Gillison and B. Bell; 1 ♂, Flying Fish Cove, 31.vii.1975; A. N. Gillison and D. Auliffe (ANIC).

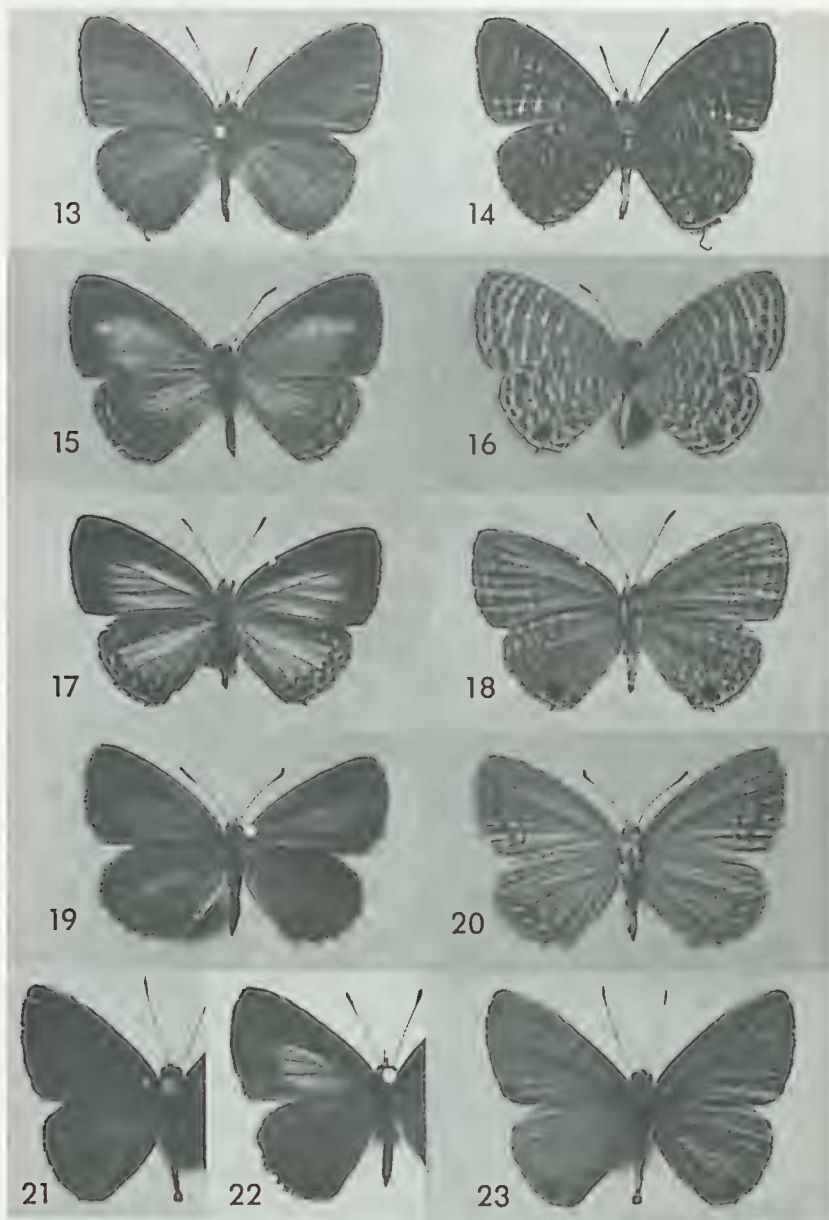
There are records for all months from May to Oct. and Jan. This species was very plentiful in January. The larvae are gregarious but despite large numbers of pupae being collected from a number of localities no adults emerged as they had all been parasitized.

### *Junonia villida* (F.)

*Junonia villida* (F.): Butler 1900: 62; Ridley, 1906: 150.

*Precis villida villida* (F.): Pendlebury, 1933: 96; Gibson-Hill, 1947: 76-77.

*Material examined.*—6 ♂♂, 18 ♀♀, Christmas Is., 12, 13, 14, 15, 16, 18, 20, 21, 25, 27, 29.i.1985, R. B. Lachlan (RBL). 1 ♂, Central Area Workshop, x.1983, L. Hill; 1 ♂, Waterfall Pumping Station, 11.x.1964, T. G. Campbell; 5 ♂♂, Plateau Area, 10.viii.1975, Flying Fish Cove, 31.vii.1975 and 5.viii.1975, Christmas Is., viii.1975, A. N. Gillison (ANIC).



Figs 13-23. (13-16) *Nacaduba kurava* (Moore): 13, male upperside; 14, male underside; 15, female upperside; 16, female underside; (17-18) *Jamides bochus* (Stoll); 17, female upperside; 18, female underside; (19-20) *Zizina otis* (F.): 19, female upperside; 20, female underside; (21-23) *Prosotas dubiosa lumpura* (Corbet): 21, male upperside; 22, female upperside; 23, male underside.

This is a common species that "can be found all the year round" Gibson-Hill (1947). Adults prefer open areas of ground.

FAMILY LYCAENIDAE

*Nacaduba kurava* (Moore)

(Figs 13-16)

*Material examined.*—2 ♂♂, Christmas Is., 18, 27.i.1985, R. B. Lachlan (RBL). 1 ♀, Egeria Point Road, 12.x.1964, T. G. Campbell and R. Bishop (ANIC).

Previously unrecorded from Christmas Island.

*Prosotas dubiosa lumpura* (Corbet)

(Figs 21-23)

*Nacaduba dubiosa lumpura* Corbet, 1938: 141, fig. 20.

*Material examined.*—7 ♂♂, 10 ♀♀, Christmas Is., 11, 12, 13, 14, 15, 16, 25, 27, 28.i.1985, R. B. Lachlan (RBL). 1 ♂, 1 ♀, Plateau Area, 10.viii.1975, Tom's Ridge Rd, 14.viii.1975, A. N. Gillison; 1 ♂, 1 ♀, Settlement, 8.x.1964, South Point, 8.x.1964, T. G. Campbell, (ANIC).

Specimens have been taken in the months of Jan., Aug. and Oct.

*Prosotas aluta* (Druce)

*Nacaduba aluta* (Druce): Butler, 1888: 544; Ridley, 1891: 131; Butler, 1900: 63; Gibson-Hill, 1947: 79.

Specimens have been recorded for Mar., Oct. and Dec.

There is some doubt about the identity of this species. Butler (1900) and Gibson-Hill (1947) say it is common but their specimens which should be in BMNH cannot be traced; they are not included in the collection under this name or under any of the other lycaenid names listed in this paper.

*Jamides bochus* (Stoll)

(Figs 17, 18)

*Material examined.*—1 ♀, Tom's Ridge Rd, 15.viii.1975, A. N. Gillison (ANIC).

Previously unrecorded from Christmas Island.

*Catochrysops panormus exiguus* (Distant)

*Material examined.*—3 ♂♂, Tom's Ridge Rd, 15.viii.1975, Flying Fish Cove, 12.viii.1975, A. N. Gillison (ANIC).

Previously unrecorded from Christmas Island.

*Lampides boeticus* (L.)

(Figs 11, 12)

*Material examined.*—1 ♂, Tom's Ridge Rd, 10.viii.1975, A. N. Gillison (ANIC).

Previously unrecorded from Christmas Island.

*Zizina otis* (F.)

(Figs 19, 20)

*Material examined.*—6 ♂♂, 6 ♀♀, Christmas Is., 11, 12, 13, 14, 15, 17, 21, 23, 27.i.1985, R. B. Lachlan (RBL). 5 ♂♂, 1 ♀, Central Plateau, x.1983, L. Hill; 1 ♂, Flying Fish Cove, 30.vii.1975, A. N. Gillison (ANIC).

Previously unrecorded from Christmas Island.



*Zizula hylax* (F.)

*Zizeeria gaika* (Trimen): Pendlebury, 1933: 97; Gibson-Hill, 1947: 80. [*gaika* is now considered a junior synonym of *hylax*].

*Material examined.*—21 ♂♂, Christmas Is., 11, 12, 16, 21.i.1985, R. B. Lachlan (RBL, BMNH).

Specimens have been taken in January, August and September. A common species along roadsides and around cultivated areas.

**Discussion**

The rainforest that covers almost the entire island contains remarkably few plant species for such a tropical climate in contrast to the nearby Indonesian islands. Many of the butterfly food plant families are absent or poorly represented. Although a high proportion of Christmas Island's fauna is endemic only 2 of the 22 butterfly species are (*viz. Eureka amplexa* and *Polyura andrewsi*) and the number of butterfly species is very low compared to the Indonesian islands to the north.

No HesperIIDae have yet been sighted or taken on the island despite the fact that some suitable food plants exist including seven species of palms (one endemic) and the introduced grass, paspalum. However, in a total view, the variety of potential hesperiid food plants is low; there are few grasses (very common food plants for Asian hesperiids), few Acanthaceae, and a total lack of several other plant families that include known hesperiid food plants in Asia.

The only Papilionidae to be recorded is *Papilio demoleus* and this only since 1961. Again the number of potential food plants for papilionids is very low, the most suitable being several introduced citrus. There is only one natural Rutaceae, no Aristolochiaceae, no Annonaceae and no Monimiaceae.

Nearly all specimens taken by RBL were collected around the Settlement/Rocky Point area in places of exotic vegetation. The natural rainforest over the entire island was found to be almost devoid of butterflies, despite a thorough investigation of many ideal collecting locations. Only *Hypolimnas anomala* and *Nacaduba kurava* were found exclusively in the natural vegetation. Five species, *Hypolimnas bolina*, *Junonia villida*, *Polyura andrewsi*, *Euploea climena* and *Catopsila pomona* were widespread. No species was taken hilltopping.

Christmas Island is generally considered to be an extinct volcano at no time associated with any other land mass. This permanent isolation and the island's depauperate flora almost certainly accounts for its relatively poor butterfly fauna. It is very likely that some species have been accidentally introduced since settlement on exotic plants and no doubt other butterflies will be introduced in similar manner in the future. It is possible that there exist further butterfly species yet to be discovered on Christmas Island, particularly migrant species.

### Acknowledgements

Col. John Eliot identified specimens of *Nacaduba kurava*, *Prosotas dubiosa*, *Zizula hylax* and *Zizina otis*; we express our appreciation to him and Dr P. R. Ackery for arranging these identifications. Dr E. S. Neilsen and Mr E. D. Edwards (ANIC) and Dr T. F. Houston (WAM) kindly loaned material from collections in their care and Dr Ackery made an extensive search for the Christmas Island specimens of "*Prosotas aluta*" in BMNH. We are grateful also to Mr E. D. Edwards for helpful comments on the manuscript.

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